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TECHNICAL REPORT NO. 67-39

DESIGNATION OF DATA RECORDED AT THE
TONTO FOREST SEISMOLOGICAL OBSERVATORY
1 May 1965 through 31 December 1966

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TECHNICAL REPORT NO. 67-39

DESIGNATION OF DATA RECORDED AT THE
TONTO FOREST SEISMOLOGICAL OBSERVATORY
1 May 1965 through 31 December 1966

Sponsored by

Advanced Research Projects Agency
Nuclear Test Detection Office
ARPA Order No. 624

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GEOTECH
A Teledyne Company
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Garland, Texas

14 July 1967

IDENTIFICATION

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ABSTRACT

This report outlines the designators used to identify the seismic and meteorological data recorded at the Tonto Forest Seismological Observatory under Project VT/5055 during the period from 1 May 1965 to 31 December 1966.

DESIGNATION OF DATA RECORDED AT THE
TONTO FOREST SEISMOLOGICAL OBSERVATORY
1 May 1965 through 31 December 1966

1. INTRODUCTION

This is a report on the identification of the seismic and meteorological data formats recorded at the Tonto Forest Seismological Observatory (TFSO), under Project VT/5055. The designations used to identify the seismograms are listed and explained, the characteristic response of each seismograph is given, and the location of seismometers are shown. The designators for the meteorological data are also listed.

2. ACQUISITION OF SEISMIC AND
METEOROLOGICAL DATA AT TFSO

2.1 GENERAL

During the period from 1 May 1965 to 31 December 1966, data produced by more than 100 seismographs were recorded at the TFSO. Seismic signals were detected from a range of 0.01 cps to 6 cps and recorded on 16-millimeter film, 35-millimeter film, and magnetic tape.

The operating parameters and tolerances for the TFSO standard seismographs are shown in table 1. Normalized response characteristics of the standard seismographs, as they were being operated on 31 December 1966 are shown in figure 1. The frequency responses with which the long-period seismographs were operated earlier in the contract period are shown in figure 2.

In addition to the standard seismographs, two band-pass filtered summation seismographs (Σ TF and Σ TFK) were operated at the observatory. The filtered-summation seismograms were used as "flag" seismograms during the routine on-line analysis of data. The Σ TF seismograph employs a filter with a pass band from 0.7 to 1.75 cps. The Σ TFK filter employs a filter with a pass band from 1.0 to 3.0 cps. The high-cut and low-cut slopes of both filters is 24 dB/octave.

Table 1. Operating parameters and tolerances of standard seismographs at TFSO

Seismograph				Operating parameters and tolerances						Filter settings	
System	Comp	Type	Model	T _s	λ _s	T _g	λ _g	δ ²	Bandpass at 3 dB cutoff (sec)	Cutoff rate at SP side (dB/oct)	
SP	Z	Johnson-Matheson	6480	1.25 ± 2%	0.54 ± 5%	0.33 ± 5%	0.65 ± 5%	0.0117	0.1 - 100	12	
SP	H	Johnson-Matheson	7515	1.25 ± 2%	0.54 ± 5%	0.23 ± 5%	0.65 ± 5%	0.0117	0.1 - 100	12	
SP	Z	Benioff	1051	1.0 ± 2%	1.0 ± 5%	0.2 ± 5%	1.0 ± 5%	0.0104	0.1 - 100	12	
SP	H	Benioff	1101	1.0 ± 2%	1.0 ± 5%	0.2 ± 5%	1.0 ± 5%	0.0104	0.1 - 100	12	
SP	Z	UA Benioff	1051	1.0 ± 2%	1.0 ± 5%	0.75	1.0 ± 5%	0.0245	0.1 - 100	12	
SP	H	UA Benioff	1101	1.0 ± 2%	1.0 ± 5%	0.75	1.0 ± 5%	0.0245	0.1 - 100	12	
SP	H	Wood-Anderson	TS 220	0.8	0.78	0.75	1.0 ± 5%	0.0245			
IB	Z	Melton	10012	2.25 ± 5%	0.65 ± 5%	0.64 ± 5%	1.2 ± 5%	0.0006	0.05 - 100	18	
IB	H	Lehner-Griffith	SH-216	2.25 ± 5%	0.65 ± 5%	0.64 ± 5%	1.2 ± 5%	0.0004	0.05 - 100	18	
BB	Z	Press-Ewing	SV-232	12.0 ± 5%	0.425 ± 10%	0.64 ± 5%	9.0 ± 10%	0.00027	0.05 - 100	18	
BB	H	Press-Ewing	SH-242	12.0 ± 5%	0.425 ± 10%	0.64 ± 5%	9.0 ± 10%	0.00027	0.05 - 100	18	
L.P. ^a	Z	Geotech	7505A	20.0 ± 5%	0.74 ± 10%	110.0 ± 10%	0.83 ± 10%	0.66	25 - 1000	12	
L.P. ^a	H	Geotech	8700C	20.0 ± 5%	0.74 ± 10%	110.0 ± 10%	0.83 ± 10%	0.66	20 - 200 ^c	12	
L.P. ^b	Z	Geotech	7505A	20.0 ± 5%	0.74 ± 10%	110.0 ± 10%	0.83 ± 10%	-	25 - 1000	12	
L.P. ^b	H	Geotech	8700C	20.0 ± 5%	0.620 ± 10%	30.0 ± 10%	0.591 ± 10%	-	25 - 1600	12	
									20 - 1000	12	
									20 - 1000 ^c	12	

KEY

SP Short period
 IB Intermediate band
 BB Broad band
 L.P. Long period
 UA Unamplified (i.e., earth power)

T_s Seismometer free period (sec)
 T_g Galvanometer free period (sec)
 λ_s Seismometer damping constant
 λ_g Galvanometer damping constant
 δ² Coupling coefficient

^aSince March 1966

^bPrior to March 1966

^cWith a 6-second notch filter

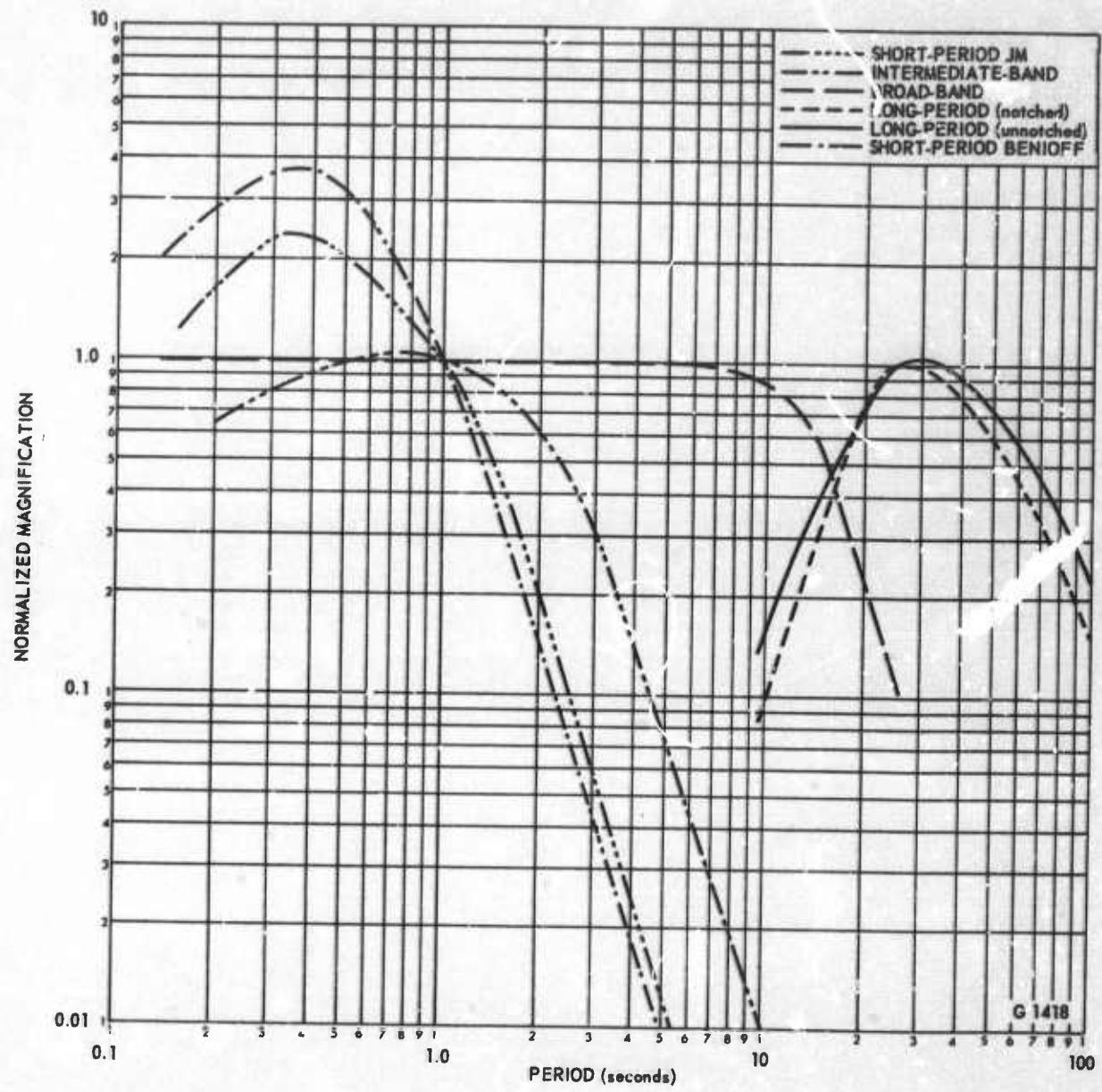


Figure 1. Normalized response characteristics of standard seismographs at TFSO

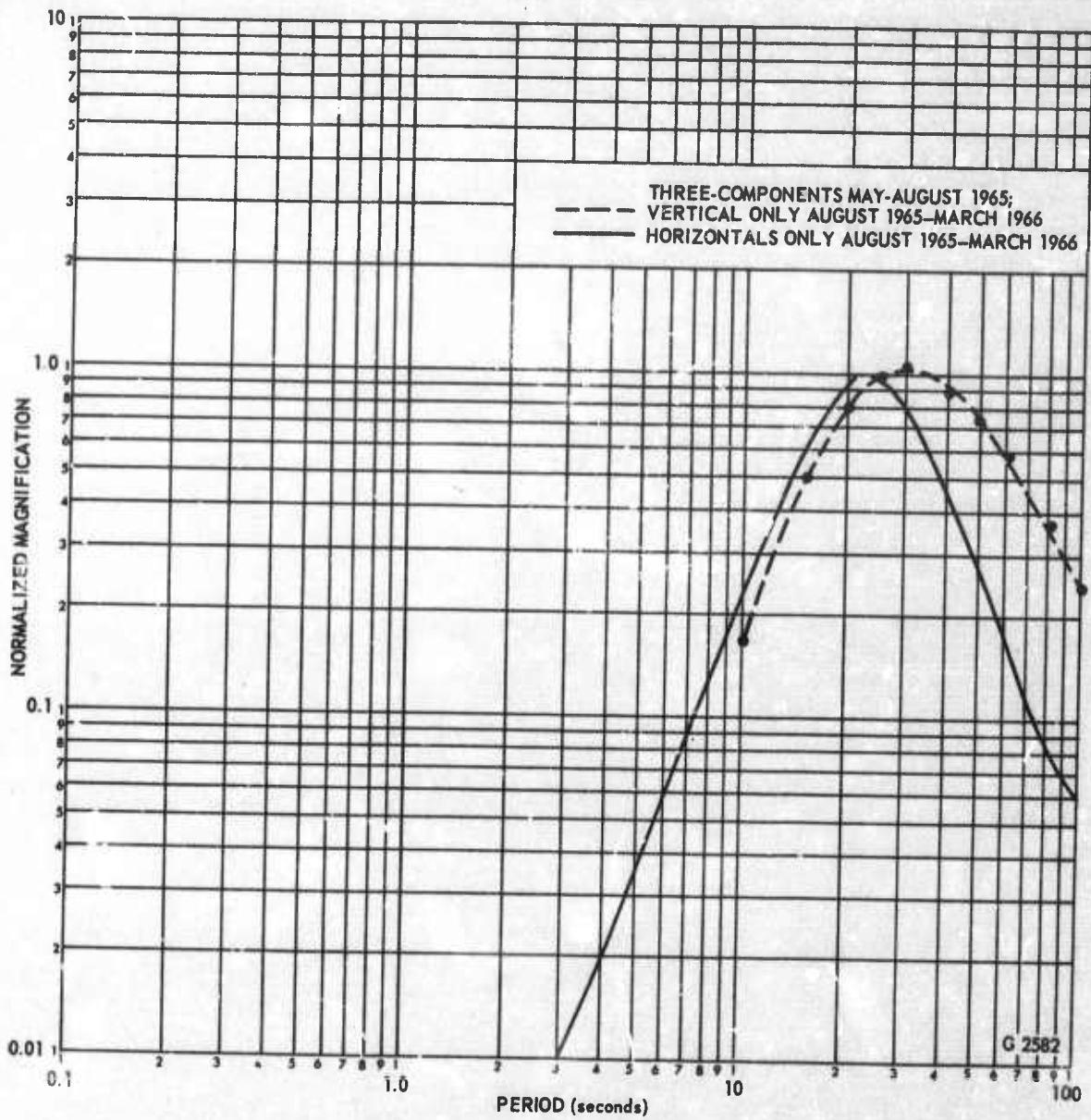


Figure 2. Normalized response characteristics of long-period seismographs at TFSO prior to March 1966

2.2 SEISMOMETER ARRAYS

The seismic data recorded at TFSO were produced by seismometers positioned to form four arrays; the crossed linear array, 31-element array, 19-element array, and the extended array. Seismometer locations which formed the 31-element and crossed linear arrays are shown in figure 3. The vault location numbers are also given in figure 3. Seismometer locations which formed the 19-element array are shown in figure 4.

The location of eight mobile seismic recording vans used to extend the legs of the crossed linear array between the beginning of Project VT/5055 and 3 October 1965 are shown in figure 5. The geographic location of TFSO is also given in the figure. Data from the extended array were transmitted to the TFSO central recording building (CRB) via telephone and VHF telemetry systems. All of the mobile sites were equipped with a 3-component short-period system and a 3-component long-period system. Seven-element short-period vertical arrays were also installed at the Winslow, Arizona (WO-AZ) and the Jerome, Arizona (JR-AZ) sites. Location of the seismometers which formed the WO-AZ and JR-AZ arrays are given in figures 6 and 7, respectively.

2.3 METEOROLOGICAL DATA

Meteorological data were recorded at TFSO. Wind velocity and barometric pressure data were recorded on 16-millimeter film.

3. DESIGNATION CODE

3.1 TFSO SHORT-PERIOD DATA DESIGNATORS

Two sets of designators were used to designate the short-period data recorded at TFSO corresponding to the three arrays that were operated during the period 1 May 1965 to 31 December 1966. Seismometer locations for the period from 1 May 1965 to 9 December 1966 are shown in figure 3, and short-period seismometer location for the period from 9 December 1966 to 31 December 1966 are shown in figure 4. The following shows the structure of the code used to identify short-period seismographs of the 31-element, crossed-linear, and 19-element arrays:

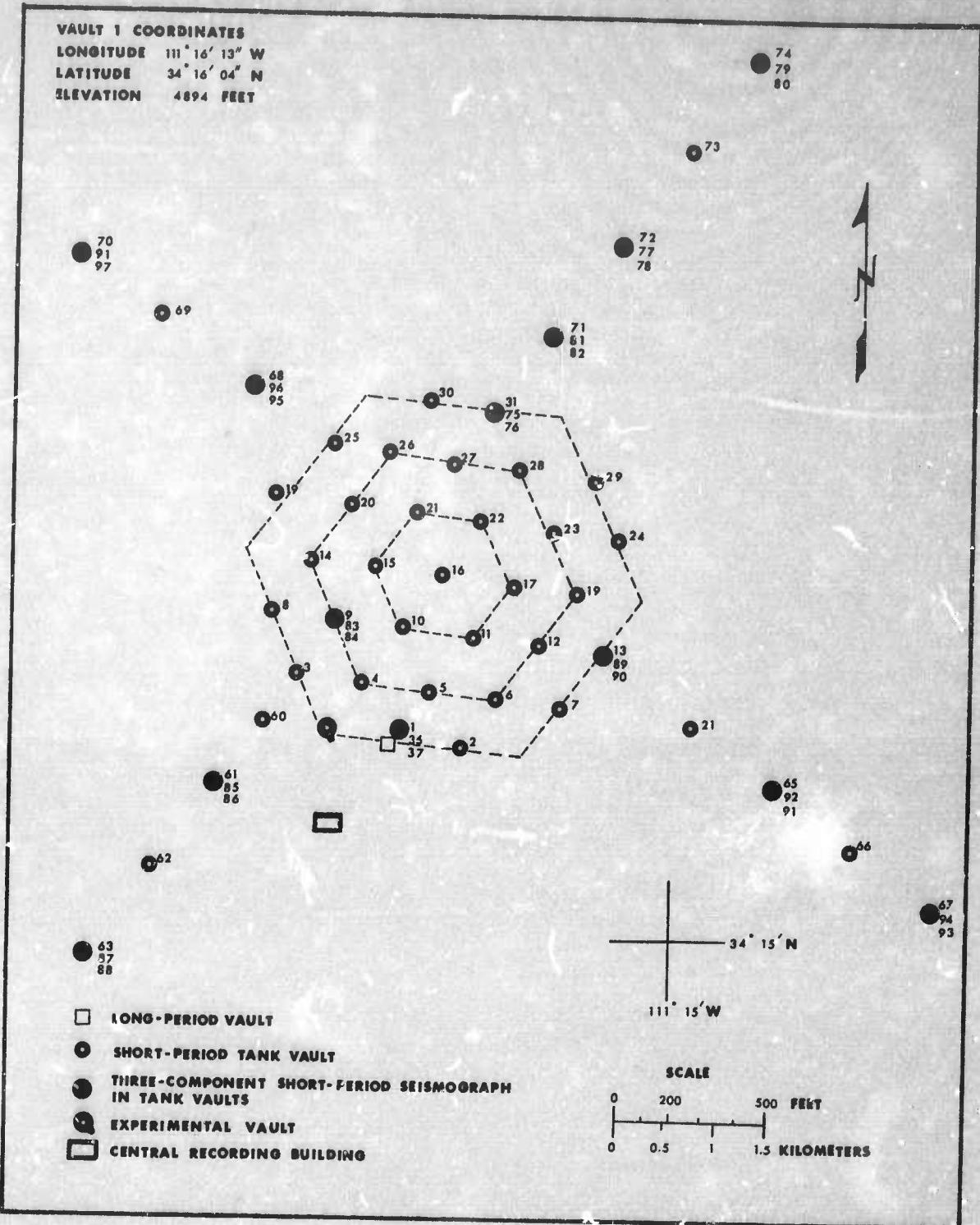


Figure 3. Location of seismometers at TFSO prior to 9 December 1966

VAULT 60 COORDINATES
LONGITUDE $111^{\circ} 16' 13''$ W
LATITUDE $34^{\circ} 16' 13''$ N
ELEVATION 4894 FEET

73
79
80

69
98
97

72
77
78



68
96
95

70
75
76

135 - 136 - 137
132 - 64 - 133
127 - 128 - 129
124 - 125 - 130
121 - 122 - 123
100

62
85
86
88

66
92
91

63
87
88

34° 15' N
111° 15' W

67
93
94

- LONG-PERIOD VAULT
- SHORT-PERIOD TANK VAULT
- THREE-COMPONENT SHORT-PERIOD SEISMOGRAPH IN TANK VAULTS
- EXPERIMENTAL VAULT
- CENTRAL RECORDING BUILDING

SCALE
 0 200 1 500 FEET
 0 0.5 1 1.5 KILOMETERS

Figure 4. Location of seismometers at TFSO after 9 December 1966

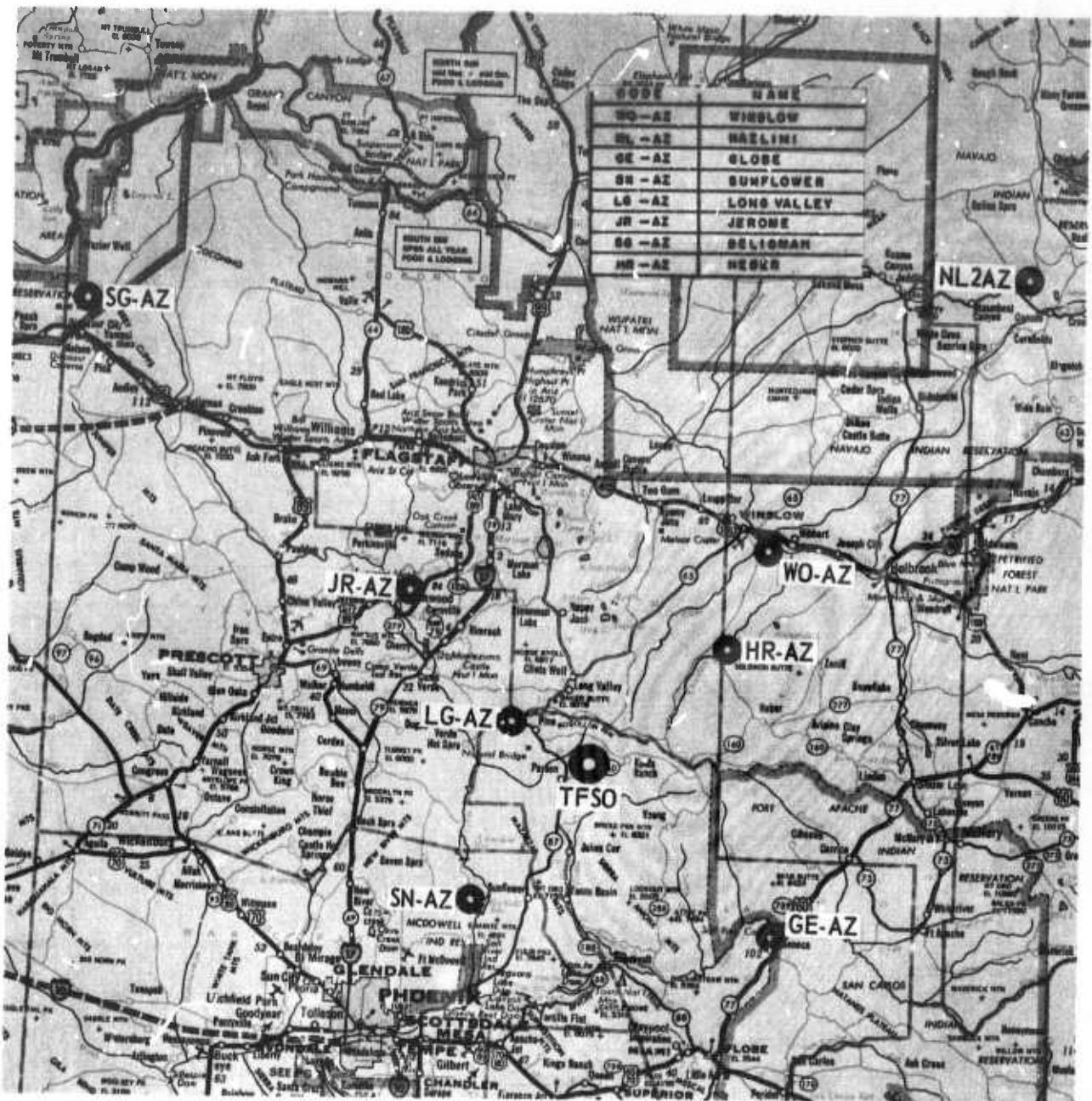


Figure 5. Locations of TFSO and extended array sites

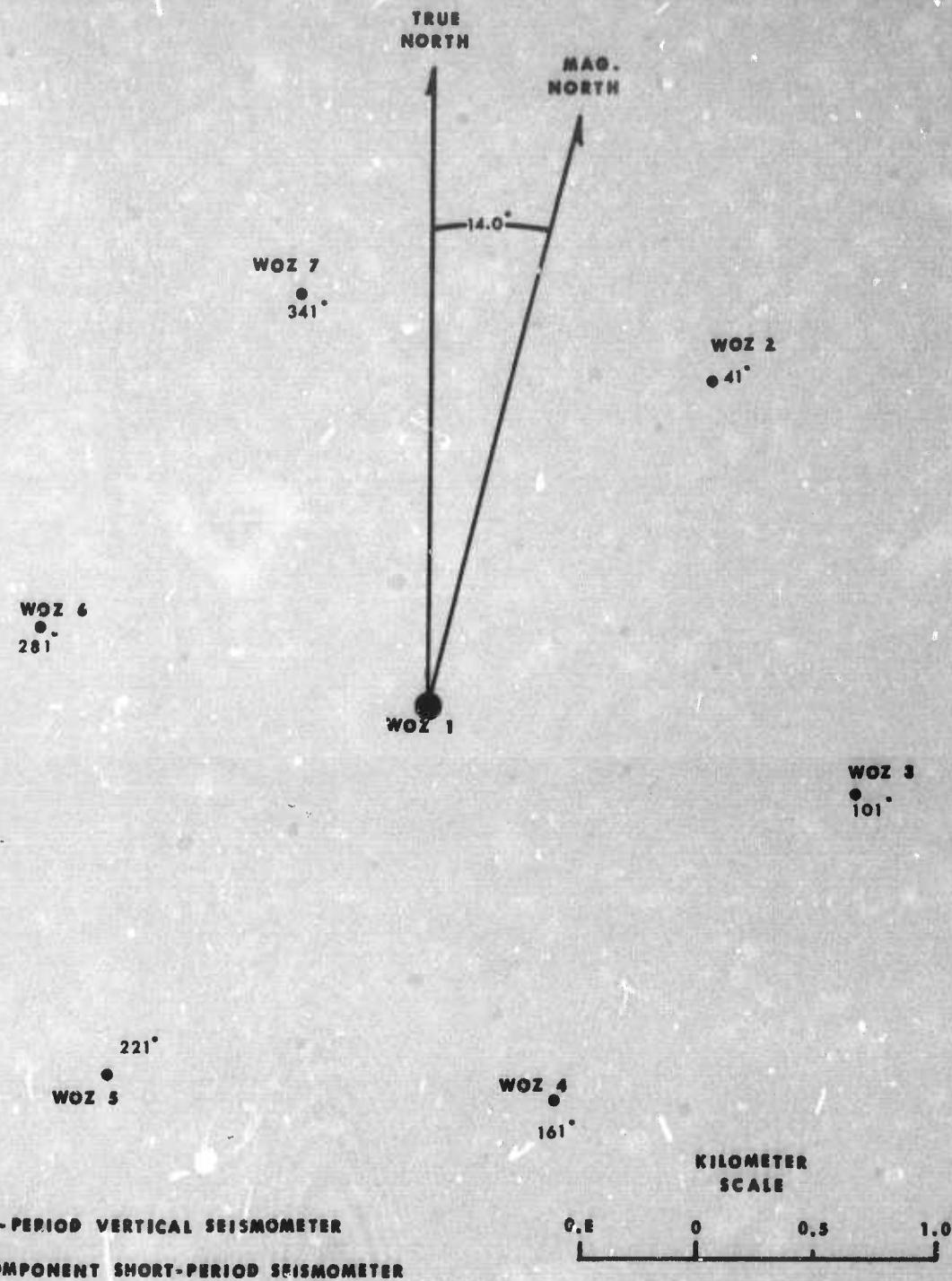


Figure 6. Location of short-period seismometers at Winslow, Arizona LRSM site

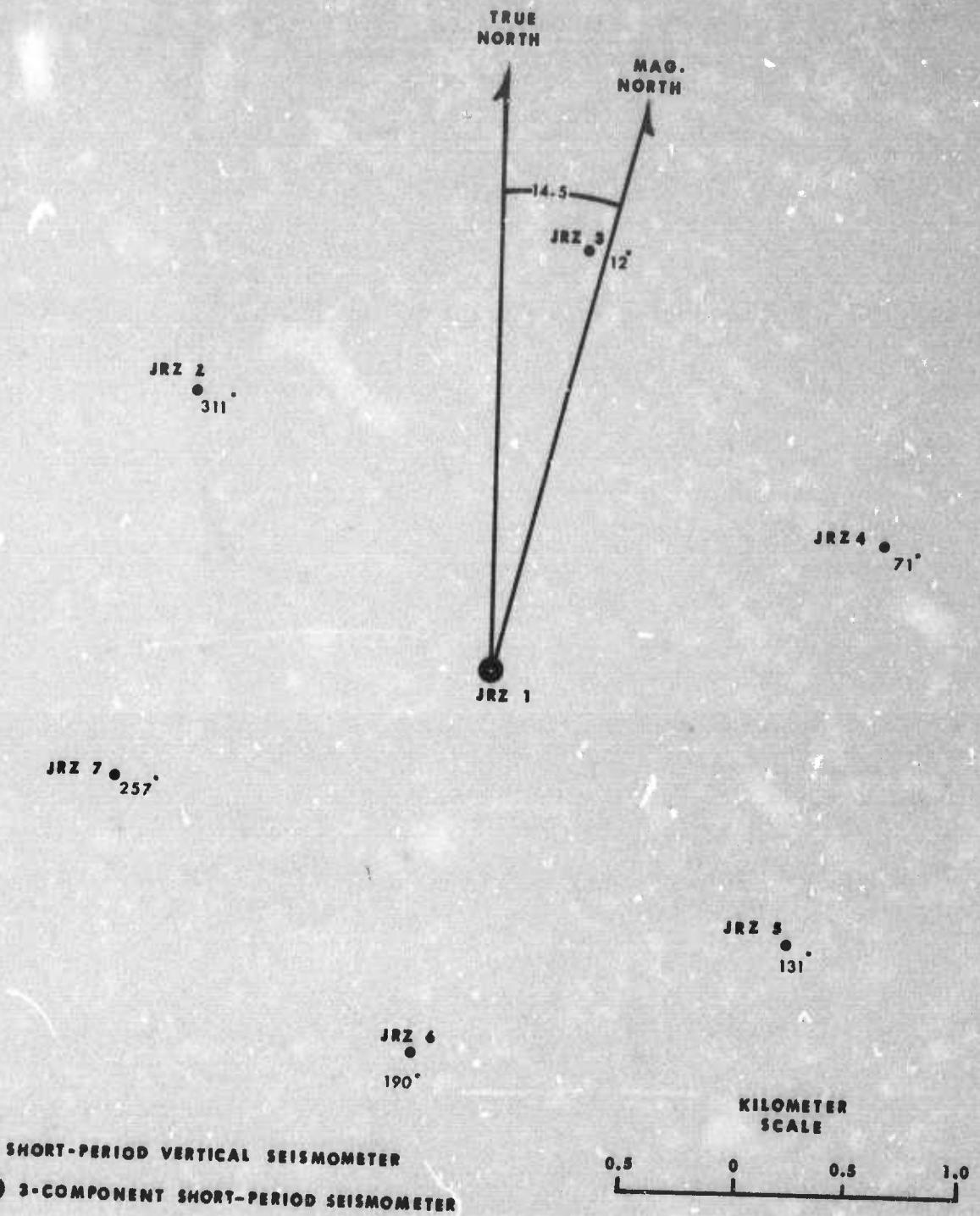


Figure 7. Location of short-period seismometers at Jerome, Arizona LRSM site

Z 33 SL

[Letters denoting relative magnification at which the systems operate. "SL" indicates low-magnification seismograph. The omission of letters indicate a high-magnification seismograph.]

[Numeral indicating location of the seismometer in the array at TFSO (see figures 3 and 4).]

[Letter designating the component of earth motion sensed by detection axis of the seismometer.]

3.2 EXTENDED ARRAY SHORT-PERIOD DATA DESIGNATORS

Data produced by the extended array seismographs were recorded at TFSO from the beginning of Project VT/5055 to 3 October 1965. The abbreviations used to designate the location in the extended array at which instruments were operated by Long Range Seismic Measurements (LRSM) teams follows:

<u>Abbreviation</u>	<u>LRSM Site</u>	<u>Horizontal Seismometer Orientation</u>	
		R	T
GE-AZ	Globe, Arizona	131°	221°
HR-AZ	Heber, Arizona	131°	221°
JR-AZ	Jerome, Arizona	131°	221°
LG-AZ	Lone Valley, Arizona	131°	221°
NL-AZ	Nazline, Arizona	131°	221°
SG-AZ	Seligman, Arizona	131°	221°
SN-AZ	Sunflower, Arizona	131°	221°
WO-AZ	Winslow, Arizona	131°	221°

The following shows the structure of the code used to identify short-period seismographs of the extended array:

NL	Z	1	BF
----	---	---	----

Letter denoting seismometer used. The letters "BF" were initially used to indicate earth motion sensed by a Benioff seismometer; however, all of the seismometers of the extended array were Benioff seismometers, therefore, the use of the BF suffix was discontinued.

Numeral indicating the location of the seismometer in the sub-array at the LRSM site (see figures 5 and 6).

Letter indicates component of earth motion sensed by detection axis of seismometer.¹

Letters designating the LRSM site from which the data were transmitted to TFSO.

3.3 EXTENDED ARRAY LONG-PERIOD DATA DESIGNATORS

Long-period data from the extended array sites were recorded at TFSO from the beginning of Project VT/5055 to 5 October 1965. The following code may be helpful in the identification of these data:

GL	LP	T
----	----	---

Letter indicating the component of earth motion sensed by seismometer.¹

Letters indicating that data were recorded with high-gain long-period seismograph with unnotched response (earth motion sensed by Sprengnether seismometer).

Letters designating the LRSM site from which the data were transmitted to TFSO.

4. NON-CODED DESIGNATIONS

4.1 TFSO LONG-PERIOD DATA DESIGNATORS

The description of the long-period seismographs at TFSO and the corresponding data designators are listed in table 2. More than 20 designators

¹Vertical, transverse and radial orientations of sensing axis of seismometer are indicated by Z, T, and R, respectively.

were used to identify long-period data produced by the long-period seismograph operated at TFSO.

Table 2. TFSO long-period data designators

<u>Data Designator</u>	<u>Seismograph Description</u>
Z44LP or GLZ44	Prior to 22 April 1966, this designator identified a high-gain vertical long-period seismograph operated with an unnotched response. After 22 April 1966, this designator identified a high-gain vertical long-period seismograph with a response notch-filtered at 6 seconds with a Model 6824-15 filter. In both seismographs a Model 7505A seismometer was used.
Z44LP(N) or GLZ44(N)	High-gain vertical long-period seismograph with response, notch-filtered at 6 seconds with Filter, Model 6824-15. The vertical component of earth motion was sensed by a Model 7505A seismometer.
Z44LL or GLZ44LG	Low-gain long-period vertical seismograph with response, notch-filtered at 6 seconds with a Model 6824-15 filter. The vertical component of earth motion was sensed with a Model 7505A seismometer.
Z51LP	High-gain long-period vertical seismograph operated with an unnotched response. The vertical component of earth motion was sensed by a Model 7505A seismometer.
E45LP or GLE45	Prior to 22 April 1966, this designator identified as high-gain long-period horizontal seismograph operated with unnotched response. After 22 April 1966, designator identified a high-gain long-period horizontal seismograph with response notch-filtered at 6 seconds with a Model 6824-15 filter. In both seismographs the east-west component of earth motion was sensed with a Model 8700C seismometer. ²
E52LP	A high-gain long-period horizontal seismograph operated with an unnotched response. The east-west component of earth motion was sensed with a Model 8700C seismometer. ²

²During the period from 17 May 1966 to 2 December 1966, seismometer was oriented north-south for test purposes.

Table 2. TFSO long-period data designators (cont.)

<u>Data Designator</u>	<u>Seismograph Description</u>
E45LL or GLE45LG	A low-gain long-period horizontal seismograph with response notch-filtered at 6 seconds with a Model 6824-15 filter. The east-west component of earth motion was sensed with a Model 8700C seismometer. ³
N46LP or GLN46	Prior to 22 April 1966, this designator identified a high-gain long-period horizontal seismograph operated with an unnotched response. After 22 April 1966, this designator identified a high-gain long-period horizontal seismograph with response notch-filtered at 6 seconds with a Model 6824-15 filter. In both seismographs, the north-south component of earth motion was sensed with a Model 8700C seismometer.
N52LP	High-gain long-period horizontal seismograph operated with an unnotched response. The north-south component of earth motion was sensed with a Model 8700C seismometer.
N46LP or GLN46LG	High-gain long-period horizontal seismograph with response notch-filtered at 6 seconds with a Model 6824-15 filter. The north-south component of earth motion sensed with a Model 8700C seismometer.
Z52LP	High-gain long-period vertical seismograph operated with an unnotched response. The vertical component of earth motion was sensed by a Sprengnether seismometer.
R53LP	High-gain long-period horizontal seismograph operated with an unnotched response. The east-west component of earth motion was sensed by a Sprengnether seismometer.
T54LP	High-gain long-period horizontal seismograph operated with an unnotched response. The north-south component of earth motion was sensed by a Sprengnether seismometer.
N57LPX	High-gain long-period horizontal seismograph operated with an unnotched response. The north-south component of earth motion was sensed by a modified (wire flexures) Model 8700C seismometer.

³Ibid

Table 2. TFSO long-period data designators (cont.)

<u>Data Designator</u>	<u>Seismograph Description</u>
N54LPX	High-gain long-period horizontal seismograph with response notch-filtered at 6 seconds with a Model 6824-15 filter. The north-south component of earth motion was sensed by a Model 7505A seismometer installed in a surface vault.
Z54LPX	High-gain long-period vertical seismograph with response notch-filtered at 6 seconds with a Model 6824-15 filter. The vertical component of earth motion was sensed by a Model 7505A seismometer installed in a surface vault.
Z57LPX	High-gain long-period vertical seismograph operated with an unnotched response. The vertical component of earth motion was sensed by a Model 7505A seismometer installed in a surface vault.

4.2 TFSO BROAD-BAND DATA DESIGNATORS

Three broad-band seismographs were operated periodically during the period from 1 May 1965 to 31 December 1966. The following table identifies the seismographs operated and the data designators used:

<u>Data Designator</u>	<u>Seismograph Description</u>
Z38BB or BBZ 38	Amplified vertical broad-band seismograph using a vertical Press-Ewing seismometer.
N4C9B	Amplified broad-band horizontal seismograph. The north-south component of earth motion was sensed by a Press-Ewing seismometer.
E39BB or BBE39	Amplified broad-band horizontal seismograph. The east-west component of earth motion was sensed by a Press-Ewing seismometer.

4.3 TFSO INTERMEDIATE-BAND DATA DESIGNATORS

Three, intermediate-band seismographs were operated periodically at TFSO during the period from 1 May 1965 to 31 December 1966. The seismographs are described and the data designators used are given in the following table:

<u>Data Designator</u>	<u>Seismograph Description</u>
IBZ41 or Z41IB	Amplified intermediate-band vertical seismograph using a Lehner-Griffith, vertical seismometer.
IBE42 or EIB42	Amplified intermediate-band horizontal seismograph. The east-west component of earth motion was sensed by Lehner-Griffith seismometer.
IBN43 or N43IB	Amplified intermediate-band horizontal seismograph. The north-south component of earth motion was sensed by a Lehner-Griffith seismometer.

4.4 TFSO HIGH-FREQUENCY DATA DESIGNATORS

Seven high-frequency seismographs were in operation intermittently from 15 September 1965 to 8 July 1966. The seismographs and the data designators used are listed in table 3. The frequency responses with which these seismographs were operated are shown in figures 8 through 11.

Table 3. TFSO high-frequency data designators

<u>Data Designator</u>	<u>Seismograph Description</u>
ZHF1	Amplified vertical high-frequency seismograph with response peaked at 6 cps.
ZHF2	Amplified vertical high-frequency seismograph with response peaked at 8 cps.
ZHF3	Amplified vertical high-frequency seismograph with response peaked at 6 cps.

Table 3. TFSO high-frequency data designators (cont.)

<u>Data Designator</u>	<u>Seismograph Description</u>
ZHF4	Amplified vertical high-frequency seismograph with response peaked at 8 cps.
ZHF5	Amplified vertical high-frequency seismograph with response peaked at 10 cps.
ZHF6	Amplified vertical high-frequency seismograph with response peaked at 10 cps.
Σ GF	Amplified vertical high-frequency seismograph comprised of 24 Century Model 12 FL, 12 cps geophones in an 880-foot array. Summed output of geophones amplified with Model 4300 PTA equipped with Model 4100-11 galvanometer.

4.5 SHALLOW-HOLE SEISMOGRAPH

Two shallow-hole seismographs were operated intermittently at TFSO during the period from 1 May 1965 to 31 December 1966. Following are the designators used to identify these data:

<u>Data Designator</u>	<u>Seismograph Description</u>
Z102SG	Amplified vertical short-period seismograph operated in a shallow hole. The seismograph consisted of a Model 20171 vertical seismometer and a Model 23168-A amplifier.
Z103SH	Amplified vertical short-period seismograph operated in a shallow hole. The seismograph consisted of a Hall Sears Model 10-1 vertical seismometer and a Texas Instruments Model RA5 amplifier.

4.6 TFSO SUMMATION . . . A DESIGNATORS

The Greek letter sigma, " Σ ," and the word "Sum" were used to indicate data summation. The systems summed and the designators used are listed in table 4.

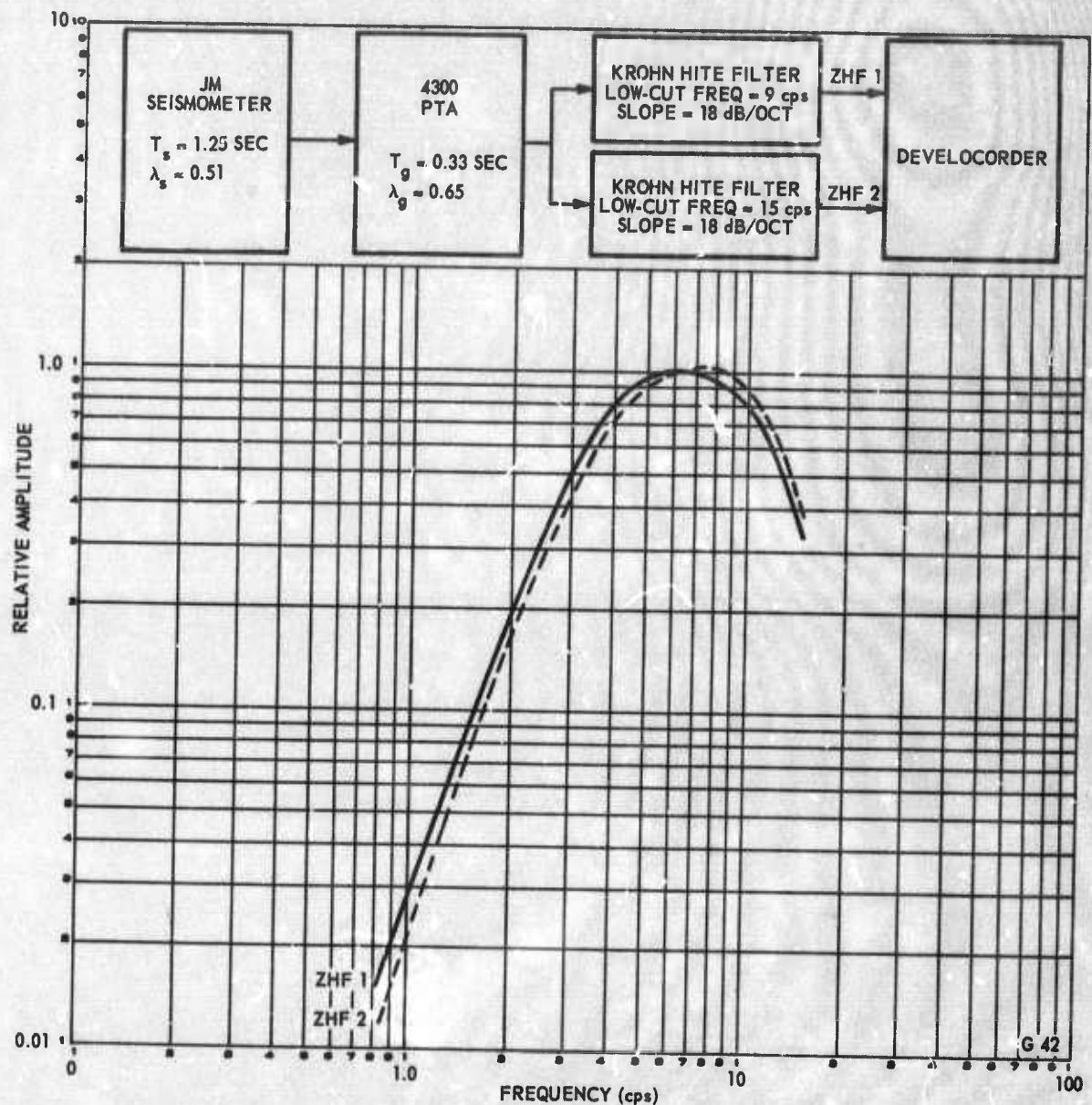


Figure 8. Frequency responses and block diagrams for ZHF1 and ZHF2

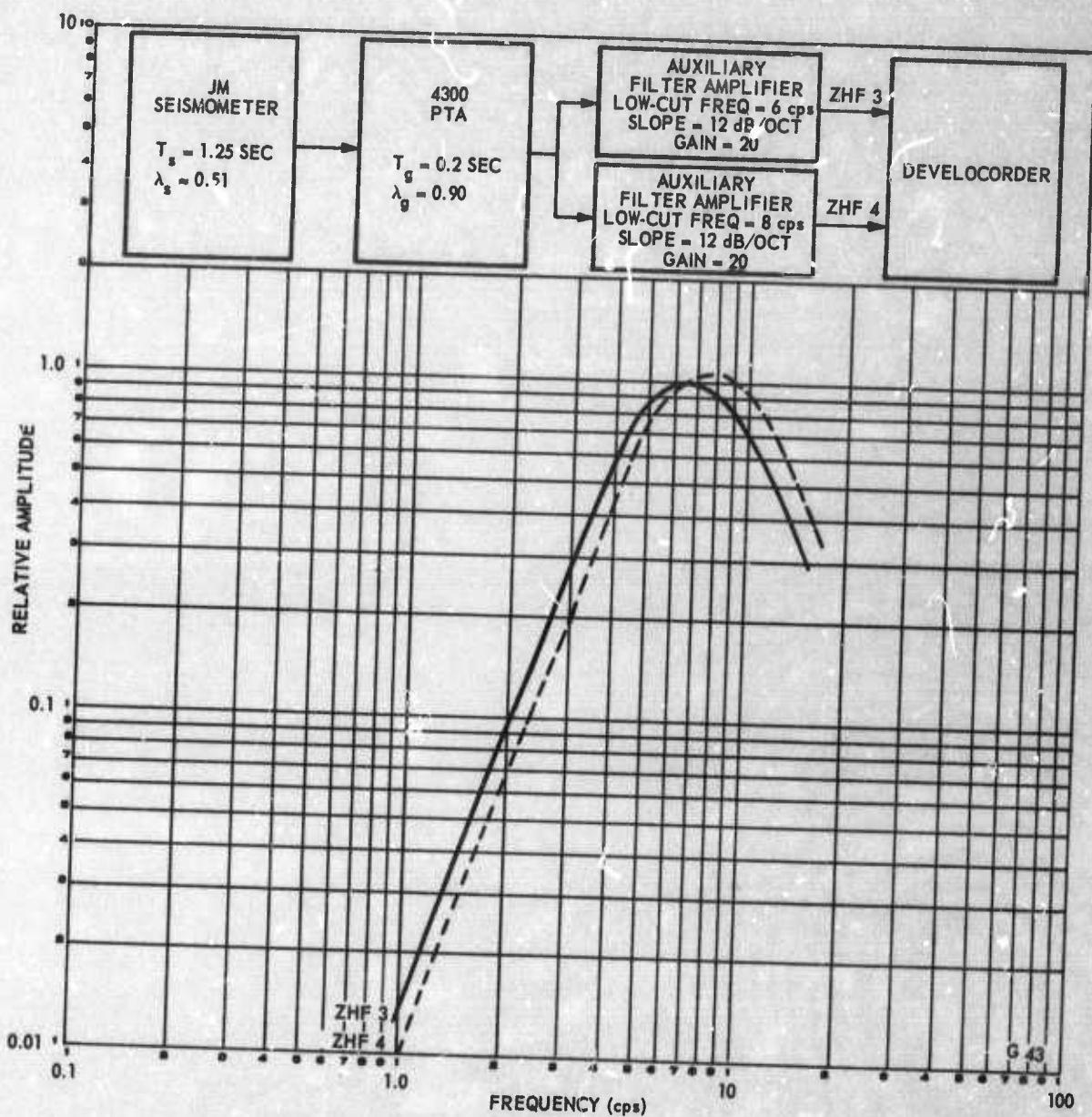
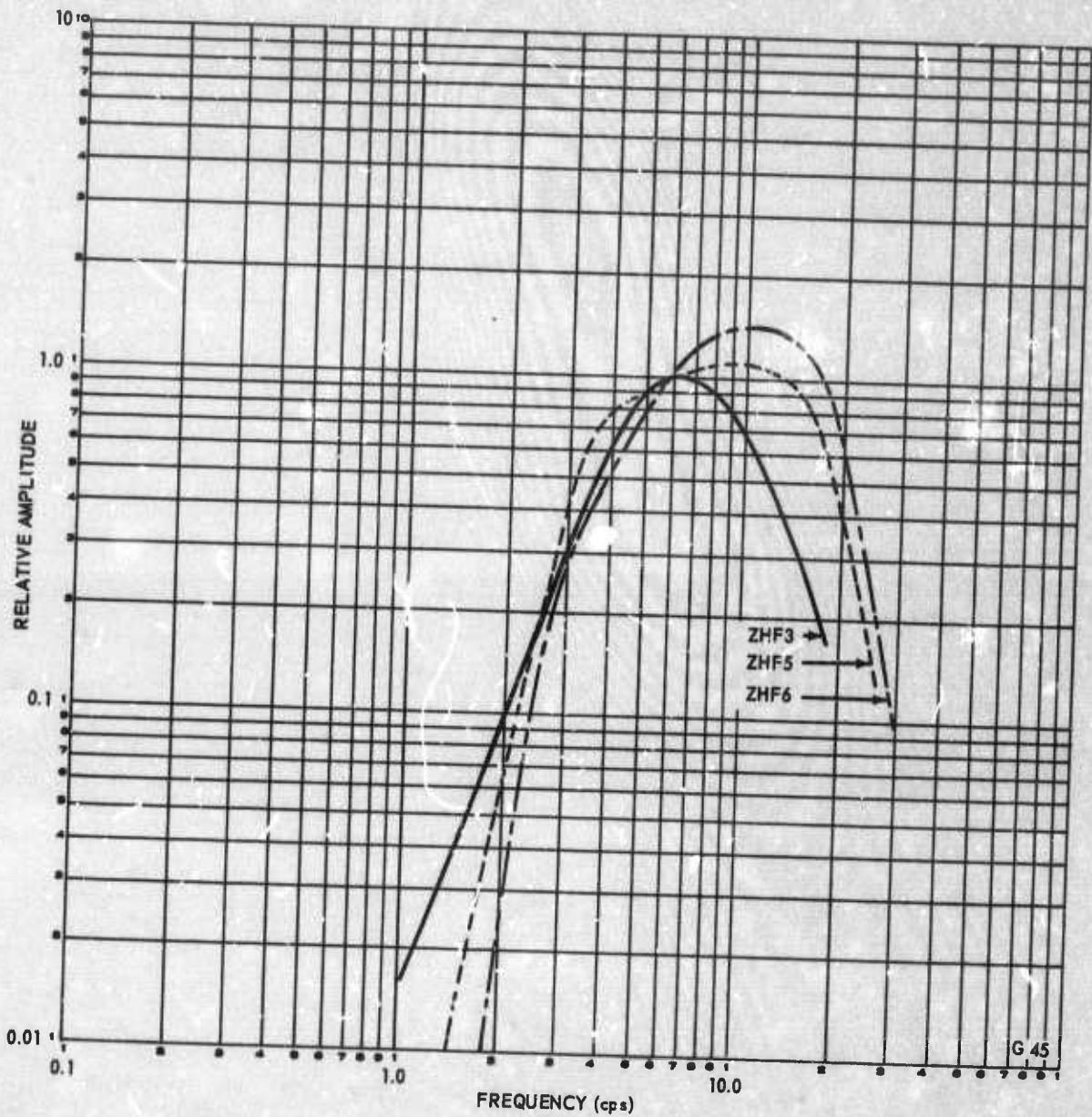


Figure 9. Frequency responses and block diagrams for ZHF3 and ZHF4



**Figure 10. Frequency responses for the high-frequency seismographs
(These responses are plotted for constant amplitude input and apply to
the film recordings.)**

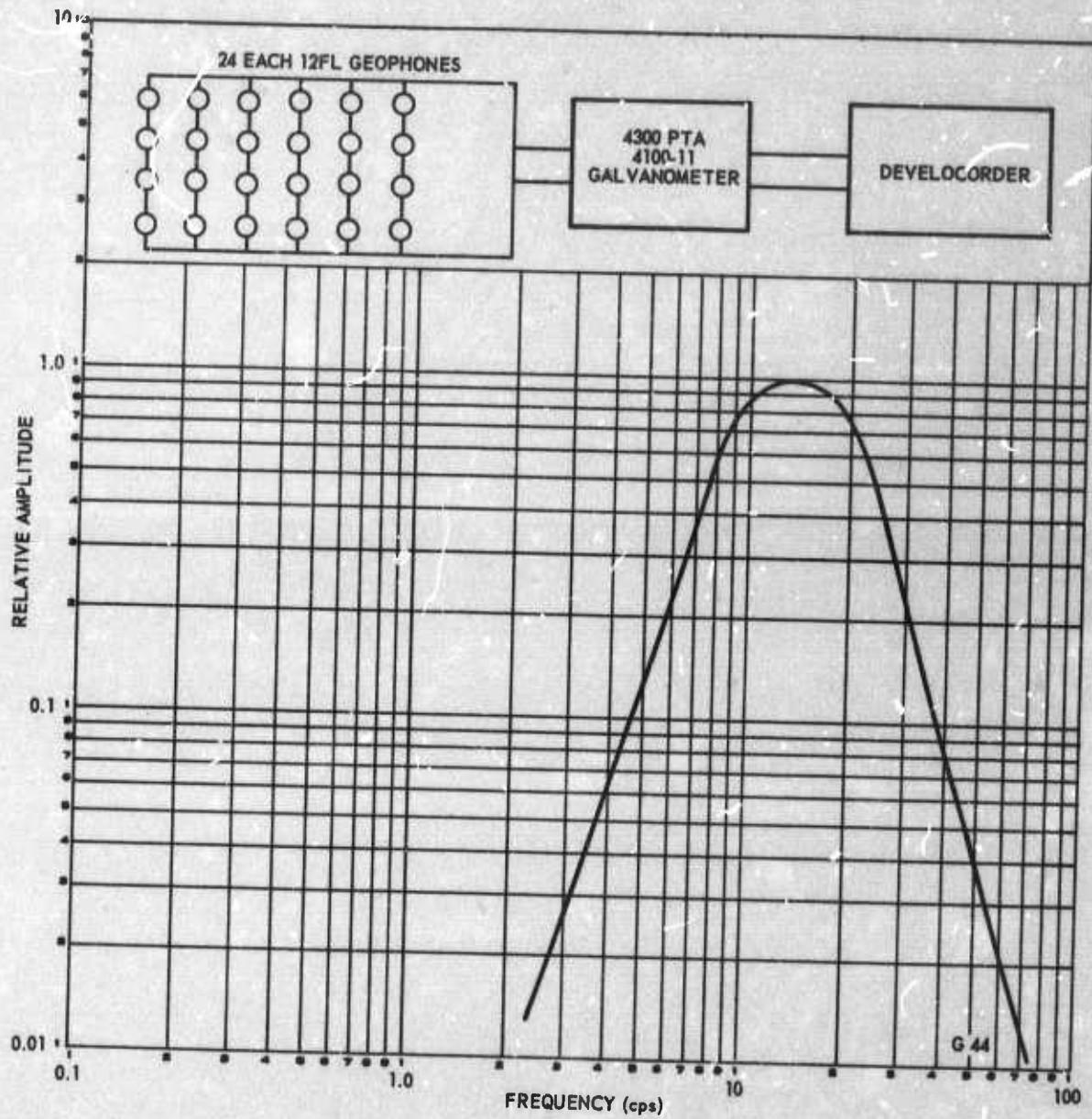


Figure 11. Block diagram and estimated frequency response for the Geophone seismograph (ΣGF)

Table 4. Designation of summed data

<u>Data Designator</u>	<u>Seismographs Summed</u>
$\Sigma A1$	Z10, Z11, Z15, Z17, Z21, and Z22
ΣB	Z1, Z2, Z3, Z4, Z5, Z6, Z7, Z8, Z9, Z10, Z11, Z12, Z14, Z15, Z16, Z17, Z18, Z19, Z20, Z21, Z22, Z23, Z24, Z25, Z26, Z27, Z28, Z29, Z30, and Z31
$\Sigma B2$	Z1, Z2, Z3, Z4, Z5, Z6, Z7, Z8, Z9, Z10, Z11, Z12, Z13, Z14, Z15, Z16, Z17, Z18, Z19, Z20, Z21, Z22, Z23, Z24, Z25, Z26, Z27, Z28, Z29, Z30, and Z31
ΣT	Z63, Z62, Z61, Z3, Z9, Z15, Z21, Z27, Z31, Z71, Z72, Z73, Z74, Z67, Z65, Z66, Z64, Z13, Z17, Z25, Z68, Z69, and Z70
ΣTF	Z1, Z2, Z3, Z4, Z5, Z6, Z7, Z8, Z9, Z10, Z11, Z12, Z13, Z14, Z15, Z16, Z17, Z18, Z19, Z20, Z21, Z22, Z23, Z24, Z25, Z26, Z27, Z28, Z29, Z30, and Z31 - Summation seismograph is filtered with a UED filter.
ΣTFK	Same as ΣTF except that filtering is accomplished with a Krohn-Hite filter.
Sum B	R76, R84, R89, and R95
Sum P(ΣNE) or ΣP	T75, T77, T79, T81, T83, T85, T87, T90, T92, T94, T96, and T98
JR Σ or JR Σ 2-7	JRZ2, JRZ3, JRZ4, JRZ5, JRZ6, and JRZ7
WO Σ or WO Σ 2-7	WOZ2, WOZ3, WOZ4, WOZ5, WOZ6, and WOZ7
ΣO or Sum O (SE)	R76, R78, R80, R82, R84, R86, R88, R89, R91, R93, R95, and R97
ΣC	T75, T83, T90, and T96

4.7 TFSO SPECIAL AND EXPERIMENTAL DATA DESIGNATORS

Several seismographs with special characteristics were operated at the observatory. These special seismographs and corresponding data designators are listed in table 5:

Table 5. TFSO special and experimental data designators

<u>Data Designator</u>	<u>Seismograph System</u>
BVF	Earth-powered vertical short-period seismograph.
Z102X	Experimental high-gain short-period vertical seismograph consisting of a Model 6480 seismometer equipped with a high impedance coil and a Model 25220 amplifier.
ZFX	High-gain short-period vertical seismograph (French seismograph).
ZIF	High-gain short-period vertical seismograph. Output of amplifier filtered with a United Electrodynamics Model 25220 filter. Vertical component of earth motion sensed with a Model 6480 seismometer.
Z47BF or BFZ47	High-gain short-period vertical seismograph.
BFE48 or E48BF	High-gain short-period horizontal seismograph. East-west component of earth motion sensed by a Model 1101 seismometer.
BFN49 or N49BF	High-gain short-period horizontal seismograph. North-south component of earth motion sensed by a Model 1101 seismometer.

5. SEISMIC DATA RECORDED ON 35-MILLIMETER
DRUM RECORDER AT TFSO

Identifiers used for seismic data recorded on 35-millimeter film at TFSO are listed in the following table:

<u>Data Designator</u>	<u>Seismograph System</u>
IA	Earth-powered short-period vertical seismograph. Vertical component of earth motion sensed by a Model 1051 seismometer.
IB	Earth-powered short-period horizontal seismograph. North-south component of earth motion sensed by a Model 1101 seismometer.
IC	Earth-powered short-period horizontal seismograph. East-west component of earth motion sensed by a Model 1101 seismometer.
ID	Earth-powered short-period horizontal seismograph. East-west component of earth motion sensed by a Wood-Anderson seismometer.
IE	Earth-powered short-period horizontal seismograph. North-south component of earth motion sensed by Wood-Anderson seismometer.

6. PHASE STUDY DATA

A phase study test was conducted at TFSO and at each LRSM site in the extended array. During these tests, the output of the function generator at each site was recorded at TFSO in order to study the phase characteristics of the systems. The designators used to identify these data were as follows:

<u>Data Designator</u>	<u>Data</u>
TFSO Test	Output of function generator at TFSO;
SG Test	Output of function generator at "SG";
JR Test	Output of function generator at "JR";
LG Test	Output of function generator at "LG";
GE Test	Output of function generator at "GE";
SN Test	Output of function generator at "SN";
HR Test	Output of function generator at "HR";
WO Test	Output of function generator at "WO";
NL Test	Output of function generator at "NL."

7. NON-SEISMIC DATA

Non-seismic data recorded at TFSO consisted of meteorological and chronological data. Designators used to identify these data are listed below:

<u>Designator</u>	<u>Data</u>
TCDMG	Time code data management generator.
WWV	Time signal transmitted from National Bureau of Standards, Radio Station WWV.
ML	Long-period microbarograph with a pass band from 0.026 to 0.0023 cps.
MS	Short-period microbarograph with a pass band from 0.046 to 1.03 cps.
WI	Output of wind direction indicator.
A	Anemometer.

8. DATA GROUP NUMBERS

8.1 A listing of data recorded on the Develocorders at TFSO, by data group number, is presented in table 6. Data group numbers for both short-period and long-period Develocorders are presented in the table.

A listing of data recorded on FM magnetic tape, by data group number, is presented in table 7.

8.2 A chronological listing of data group numbers for data recorded on the Develocorders at TFSO is presented in table 8, and a chronological listing of data group numbers for data recorded on FM magnetic tape is presented in table 9.

**Table 6. Developocorder data channel assignment at TFSO
from 1 May 1965 to 31 December 1966**

Short-Period Developocorder																					
Chn. No.	Date Group 7040 1 May 65- 9 Dec 66	Date Group 7090 1 May 65- 9 Dec 66	Date Group 7104 1 May 65- 15 July 65	Date Group 7105 1 May 65- 15 July 65	Date Group 7106 1 May 65- 14 July 65	Date Group 7116 1 May 65- 15 July 65	Date Group 7118 1 May 65- 1 Sept 65	L-1a Group 7119	Date Group 7120 1 May 65- 14 May 65	Date Group 7132 14 May 65- 29 June 65	Date Group 7132 5 June 65- 19 June 65	Date Group 7133 14 May 65- 29 June 65	Date Group 7133 15 July 65- 26 June 65	Date Group 7133 1 Sept 65	Date Group 7141 26 June 65- 14 July 65	Date Group 7144 14 July 65- 15 July 65	Date Group 7145 15 July 65- 25 July 65				
1 Z NE75	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG			
2 SE76	Z8	NE96	NE81	NE98	E36	SGZ	SGZ	SNZ	SGZ	SGZ	SNZ	SNZ	S62	S62	S62	S62	S62	S62	S62		
3 Z31	Z11	NE92	NE93	NE87	N37	JRZ	SGR	SNR	SGR	SGR	SNR	SNR	Z16	Z16	Z16	Z16	Z16	Z16	Z16		
4 S Z63	Z12	NE77	NE83	NE94	Z1	LGZ	SMT	SMT	SGT	SGT	SNT	SNT	ZAL	ZAL	ZAL	ZAL	ZAL	ZAL	ZAL		
5 Z60	Z14	NE85	SE82	NE79	Z2	Z73	JRZ	BFZ47	JRZ	JRZ	BFZ47	BFZ47	SGR	SGR	SGR	SGR	SGR	SGR	SGR		
6 Z61	Z16	Z62	SE89	Z4	ZS	Z67	JRR	Z74	JRR	JRR	Z74	Z74	S62	S62	S62	S62	S62	S62	S62		
7 Z15	Z19	SE95	SE84	Z6	Z10	GEZ	JRT	HRZ	JRT	JRT	HRZ	HRZ	Z16	Z16	Z16	Z16	Z16	Z16	Z16		
8 Z27	Z21	SE91	Z3	SE97	Z20	MLZ	LGZ	HRR	LGZ	LGZ	HRR	HRR	Z16	Z16	Z16	Z16	Z16	Z16	Z16		
9 Z71	ZZZ	SE78	Z13	SE88	Z1F	W0Z	LGR	HRT	LGR	LGR	HRT	HRT	Z16	Z16	Z16	Z16	Z16	Z16	Z16		
10 Z73	Z23	SE86	Z7	SE93	ZA2	HRZ	LGT	W0Z	LGT	LGT	W0Z	W0Z	Z16	Z16	Z16	Z16	Z16	Z16	Z16		
11 Z67	Z24	Z66	Z9	SE80	ZB	Z74	Z70	W0R	Z70	Z70	K0R	K0R	Z16	Z16	Z16	Z16	Z16	Z16	Z16		
12 Z64	Z26	Z61	Z18	E36L6	Z63	Z67	W0T	Z67	Z67	W0T	W0T	W0T	Z16	Z16	Z16	Z16	Z16	Z16	Z16		
13 Z17	Z28	Z72	BFZ47	N37L6	SNZ	GEZ	GER	GER	GEZ	GEZ	GER	GER	Z16	Z16	Z16	Z16	Z16	Z16	Z16		
14 Z25	Z29	Z68	8FE48	Z1L6	GLE4S	NLR	GET	GET	GET	GET	GET	GET	Z16	Z16	Z16	Z16	Z16	Z16	Z16		
15 ZC9	Z30	Z65	8FN49	GLN46	WWV	WWV	WWV	WWV	WWV	WWV	WWV	WWV	Z16	Z16	Z16	Z16	Z16	Z16	Z16		
16 WMV	WWV	WWV	WWV	WWV	WWV	WWV	WWV	WWV	WWV	WWV	WWV	WWV	WWV	WWV	WWV	WWV	WWV	WWV	WWV		
Chn. No.	Date Group 7146 15 July 65- 9 Dec 66	Date Group 7147 15 July 65- 26 July 65	Date Group 7148 15 July 65- 24 Sept 65	Date Group 7149 1 Feb 66	Date Group 7153 26 July 65- 1 Sep 65	Date Group 7154 26 July 65- 1 Feb 66	Date Group 7155 26 July 65- 20 Sept 65	Date Group 7156 26 July 65- 28 July 65	Date Group 7162 20 Sept 65- 20 Sept 66	Date Group 7163 24 Sept 65- 7 Oct 65	Date Group 7164 24 Sept 65- 7 Oct 65	Date Group 7165 24 Sept 65- 8 July 66	Date Group 7166 24 Sept 65- 10 Nov 65	Date Group 7167 20 Oct 65- 1 Nov 65	Date Group 7168 12 Nov 65- 21 Jan 66	Date Group 7169 18 Nov 65- 29 Nov 65	Date Group 7170 29 Nov 65- 1 Feb 66	Date Group 7171 21 Jan 66- 11 May 66			
1 Z NE96	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG		
2 NE92	SG Test	SG Test	SG Test	Z411B	SGZ	SGZ	SG Test	Z99	Z74	ZS	Z99	Z99	BVF	BVF	BVF	BVF	BVF	BVF	BVF		
3 NE90	JR Test	JR Test	JR Test	N431B	SGR	SGR	JRZ	ZHF1	JRZ	R80	Z4	Z4	Z99	Z99	Z99	Z99	Z99	Z99	Z99		
4 NE77	LG Test	LG Test	LG Test	E421B	SNT	SNT	LG Test	ZHF2	LGZ	T79	Z7	Z7	Z4	Z4	Z4	Z4	Z4	Z4	Z4		
5 NEBS	SE82	GE Test	GE Test	Z31	JRZ	Z47BF	GE Test	ZHF3	GEZ	Z67	Z47BF	Z47BF	ZHF-3	ZHF-3	ZHF-3	ZHF-3	ZHF-3	ZHF-3	ZHF-3		
6 NE98	SE89	SN Test	SN Test	Z3	JRZ	Z74	SN Test	ZHF4	SNZ	R93	Z1B	Z1B	Z5	Z5	Z5	Z5	Z5	Z5	Z5		
7 SE95	SE84	HR Test	HR Test	Z13	JRZ	HRZ	HR Test	ZHF5	HRZ	T94	Z20	Z20	Z6	Z6	Z6	Z6	Z6	Z6	Z6		
8 SE91	ZTF	MO Test	MO Test	Z2	LGZ	MRR	MO Test	ZHF6	W0Z	Z63	Z62	Z62	Z18	Z18	Z18	Z18	Z18	Z18	Z18		
9 SE78	Z13	NL Test	NL Test	Z16	MRT	MRT	NL Test	ZHF7	NLZ	R88	Z66	Z66	Z20	Z20	Z20	Z20	Z20	Z20	Z20		
10 SE86	Z9	A	A	ZA1	Z7	W0Z	A	Z7	Z7	A	T87	A	Z18	Z18	Z18	Z18	Z18	Z18	Z18		
11 SE97	NE87	TFU Test	TFU Test	Z1	Z7F	W0Z1	TFU Test	Z1	Z1	Z1	Z70	Z70	Z6	Z6	Z6	Z6	Z6	Z6	Z6		
12 Z61	Z1L	Z1L	Z1L	Z1	Z80	W0Z4	Z1L	Z1L	Z1L	R97	Z1L	Z1L	Z6	Z6	Z6	Z6	Z6	Z6	Z6		
13 Z72	NE79	N37SL	N37SL	Z1	GEZ	NLZ	N37SL	Z1	N37SL	T98	N37SL	N37SL	Z18	Z18	Z18	Z18	Z18	Z18	Z18		
14 Z68	SE88	E36SL	E36SL	Z1	GLR	MLR	E36SL	Z1	Z1	E36SL	Z1	Z1	Z6	Z6	Z6	Z6	Z6	Z6	Z6		
15 Z6S	SE93	WWV	WWV	Z1	GET	NLT	WWV	Z1	WWV	WWV	WWV	WWV	Z1F	Z1F	Z1F	Z1F	Z1F	Z1F	Z1F		
Chn. No.	Date Group 7176 1 Feb 66- 9 Dec 66	Date Group 7180 1 Feb 66- 20 May 66	Date Group 7182 11 May 66- 20 May 66	Date Group 7183 20 May 66- 20 July 66	Date Group 7185 20 May 66- 14 July 66	Date Group 7186 8 July 66- 24 Nov 66	Date Group 7187 24 Nov 66- 24 Nov 66	Date Group 7188 14 July 66- 24 Nov 66	Date Group 7189 24 Nov 66- 24 Nov 66	Date Group 7190 24 Nov 66- 9 Dec 66	Date Group 7191 24 Nov 66- 9 Dec 66	Date Group 7192 9 Dec 66- 9 Dec 66	Date Group 7193 9 Dec 66- 9 Dec 66	Date Group 7194 9 Dec 66- 31 Dec 66	Date Group 7200 9 Dec 66- 31 Dec 66	Date Group 7201 9 Dec 66- 31 Dec 66	Date Group 7202 9 Dec 66- 31 Dec 66	Date Group 7204 9 Dec 66- 31 Dec 66			
1 Z31	Z99	ZHF-3	ZHF-3	ZS	Z81	Z74	Z18	Z74	Z18	Z74	Z136	Z136	Z132	Z132	Z132	Z132	Z132	Z132	Z132		
2 ZB	Z6	ZHF-S	ZHF-S	Z6	T90	R80	Z6	R80	Z6	R80	Z76	Z76	T90	T90	T90	T90	T90	T90	T90		
3 Z2	Z18	ZHF-6	ZHF-6	Z18	T83	Z79	Z5	T79	Z122	T79	T77	T77	T92	T92	T92	T92	T92	T92	T92		
4 S Z13	Z62	Z100	Z62	Z62	R82	Z10	Z99	Z10	N37LL	Z10	Z131	Z131	T79	T79	T79	T79	T79	T79	T79		
5 Z16	Z47BF	Z102SG	Z102SG	Z47BF	R89	Z3	Z47BF	Z3	E36LL	Z3	Z129	Z129	T79	T79	T79	T79	T79	T79	T79		
6 Z20	MS	Z103SH	Z103SH	MS	R84	Z66	MS	Z66	MS	Z66	Z126	Z126	R84	R84	R84	R84	R84	R84	R84		
7 Z4	Z411B	ZFX	ZFX	Z411B	Z100	Z100	Z100	Z100	WI	Z100	Z124	Z124	Z128	Z128	Z128	Z128	Z128	Z128	Z128		
8 Z7	N431B	MS	MS	N431B	Z13	Z102SG	N431B	N431B	MS	N431B	Z130	Z130	Z78	Z78	Z78	Z78	Z78	Z78	Z78		
9 ZT	E4Z18	WI	WWV	E4Z18	Z9	Z103SH	E421B	E421B	HI	E421B	Z100	Z100	Z133	Z133	Z133	Z133	Z133	Z133	Z133		
10 ZTF	Z1SL	BFV	BFV	Z1SL	T87	ZFX	BFV	BFV	BFV	Z102X	Z102X	Z102X	Z67	Z67	Z67	Z67	Z67	Z67	Z67		
11 Z1	N37SL	Z1SL	Z1SL	N37SL	T94	MS	Z1SL	Z1SL	WI	N37SL	Z134	Z134	Z6	Z6	Z6	Z6	Z6	Z6	Z6		
12 Z14	N37SP	E36SL	E36SL	N37SP	Z70	WI	N37SL	N37SL	WI	N37SL	Z135	Z135	Z68	Z68	Z68	Z68	Z68	Z68	Z68		
13 Z15	E36SP	WWV	WWV	E36SP	R93	WWV	E36SL	E36SL	WWV	E36SL	Z137	Z137	WWV	WWV	WWV	WWV	WWV	WWV	WWV		
Chn. No.	Date Group 7126 1 May 65- 15 July 65	Date Group 7139 5 June 65	Date Group 7139 19 June 65	Date Group 7139 1 Sept 65- 5 Sept 65	Date Group 7140 29 May 65- 26 June 65	Date Group 7140 19 June 65- 3 Oct 65	Date Group 7140 1 Sept 65- 15 July 65	Date Group 7141 26 June 65- 15 July 65	Date Group 7141 1 Sept 65- 1 Sept 65	Date Group 7142 1 Sept 65- 28 Dec 65	Date Group 7156 1 Sept 65- 28 Dec 65	Date Group 7156 1 Sept 65- 22 April 66	Date Group 7176 22 Dec 65- 20 May 66	Date Group 7181 20 May 66- 31 Dec 66	Date Group 7184 20 May 66- 16 Aug 66	Date Group 7189 16 Aug 66- 9 Dec 66	Date Group 7199 9 Dec 66- 31 Dec 66				
1 ZBZ38	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	Z3888	Z3888	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG	TCMDG		
2 BBE39	SGLPZ	SGLPZ	SGLPZ	SGLPZ	SGLPZ	SGLPZ	SGLPZ	SGLPZ	SGLPZ	SGLPZ	Z1	N408B	N408B	470	470	470	470	470	470	470	
3 BBN40	SGLPZ	SGLPZ	SGLPZ	SGLPZ	SGLPZ	SGLPZ	SGLPZ	SGLPZ	SGLPZ	SGLPZ	N408B	MS	E398B	E398B	267	267	267	267	267	267	267
4 BBE41	JRLPZ	JRLPZ	JRLPZ	JRLPZ	JRLPZ	JRLPZ	JRLPZ	JRLPZ	JRLPZ	JRLPZ	BBE39	E398B	E398B	E398B	E398B	E398B	E398B	E398B	E398B	E398B	
5 BE42	JRLPR	JRLPR	JRLPR	JRLPR	JRLPR	JRLPR	JRLPR	JRLPR	JRLPR	JRLPR	BBN40	E398B	E398B	E398B	E398B	E398B	E398B	E398B	E398B	E398B	
6 BE43	JRLPT	JRLPT	JRLPT	JRLPT	JRLPT	JRLPT	JRLPT	JRLPT	JRLPT	JRLPT	BBLZ4	E398B	E398B	E398B	E398B	E398B	E398B	E398B	E398B	E398B	
7 BE44	GLZ44(N)	LGLPZ	LGLPZ	WOLPZ	WOLPZ	WOLPZ	WOLPZ	WOLPZ	WOLPZ	WOLPZ	GLZ44(N)	N46LP	N46LP	N46LP	N46LP	N46LP	N46LP	N46LP	N46LP	N46LP	
8 GLE45	LGLPR	LGLPR	LGLPR	LGLPT	LGLPT	LGLPT	LGLPT	LGLPT	LGLPT	LGLPT	GLE45	ML	E45LP	E45LP	274	274	274	274	274	274	274
9 GLE46	GELPZ	GELPZ	GELPZ	GELPZ	GELPZ	GELPZ	GELPZ	GELPZ	GELPZ	GELPZ	GLE45	ML	ZS2LP	ZS2LP	Z73	Z73	Z73	Z73	Z73		

Table 7. Magnetic-tape recorder data channel assignments at TFSO from 1 May 1965 to 31 December 1966

Table 8. Chronological listing of Develocorder
data groups recorded at TFSO

<u>Date</u>	<u>Develocorder</u>									
	1	2	3	4	5	6	7	8	9	10
1 May 1965	7116	7128	7119	7120	7040	7104	7105	7090	7118	7106
14 May 1965	"	"	7133	"	"	"	"	"	7134	"
29 May 1965	"	"	7139	7140	"	"	"	"	"	"
5 June 1965	"	"	7132	7133	"	"	"	"	"	"
19 June 1965	"	"	7139	7140	"	"	"	"	"	"
26 June 1965	"	"	7141	7142	"	"	"	"	"	"
14 July 1965	"	"	"	"	"	"	"	"	"	7144
15 July 1965	7149	7150	7145	7133	"	7146	7147	"	"	7148
26 July 1965	"	"	7153	7154	"	"	"	"	"	7155
28 July 1965	"	"	7145	7133	"	"	"	"	"	7148
1 Sept. 1965	"	7156	7139	7140	"	"	"	"	"	"
3 Sept. 1965	"	"	"	"	"	"	"	"	END	"
16 Sept. 1965	"	"	"	"	"	"	"	"	7162	"
24 Sept. 1965	"	"	"	"	"	"	"	"	"	7163
3 Oct. 1965	"	"	"	END	"	"	"	"	"	"
5 Oct. 1965	"	"	7164		"	"	"	"	"	"
7 Oct. 1965	"	"	"		"	"	"	"	"	7166
20 Oct. 1965	"	"	"		"	"	"	"	7167	"
1 Nov. 1965	"	"	"		"	"	"	"	7170	"
12 Nov. 1965	"	"	"		"	"	"	"	7172	"
18 Nov. 1965	"	"	"		"	"	"	"	"	7173
28 Dec. 1965	"	7176	"		"	"	"	"	"	7177
21 Jan. 1966	"	"	"		"	"	"	"	7178	"
1 Feb. 1966	7179	"	"		"	"	"	"	"	7180
22 Apr. 1966	"	7181	"		"	"	"	"	"	"
11 May 1966	"	"	"		"	"	"	"	7182	"
20 May 1966	"	7184	"		"	"	"	"	7183	7185
8 July 1966	"	"	END		"	"	"	"	"	"
14 July 1966	"	"			"	"	7186	"	7187	"
16 Aug. 1966	"	"	7189		"	"	"	"	"	7188
24 Sept. 1966	"	"	"		"	"	"	"	7190	"
24 Nov. 1966	"	"	"		"	"	"	"	7194	7192
9 Dec. 1966	7198	"	7199		7200	7201	7202	END	7203	7204

Table 9. Chronological listing of magnetic tape
data groups recorded at TFSO

<u>Date</u>	<u>Magnetic Tape Recorder</u>					
	1	2	3	4	5	6
1 May 1965	7110	7112	7063	7129	7127	7122
4 May 1965	7107	"	"	7108	"	"
25 May 1965	7135	"	"	7136	"	"
28 May 1965	7137	"	"	7138	"	"
5 June 1965	7135	"	"	7136	"	"
19 June 1965	7137	"	"	7138	"	"
26 June 1965	7135	"	"	7136	"	"
14 July 1965	"	"	"	"	"	7143
15 July 1965	"	"	"	"	"	7131
26 July 1965	7152	"	"	7151	"	"
28 July 1965	7148	"	"	7135		"
1 Sept. 1965	7157	"	"	7158	7159	7160
3 Sept. 1965	"	"	7161	"	"	"
3 Oct. 1965	"	"	"	"	"	END
5 Oct. 1965	7065	"	"	7064	7063	
7 Oct. 1965	"	"	"	"	"	7169
20 Oct. 1965	"	"	"	"	"	"
21 Oct. 1965	"	"	7168	"	"	"
23 Oct. 1965	"	"	"	"	"	"
2 Nov. 1965	"	"	7171	"	"	"
9 Dec. 1965	"	"	7174	"	"	"
23 Dec. 1965	"	"	7175	"	"	"
8 July 1966	"	"	END	"	"	"
17 Nov. 1966	"	"		"	"	7191
24 Nov. 1966	"	7193		"	"	"
9 Dec. 1966	"	7195		"	7196	7197

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13. ABSTRACT		

This report outlines the designators used to identify the seismic and meteorological data recorded at the Tonto Forest Seismological Observatory under Project VT/5055 during the period from 1 May 1965 to 31 December 1966.

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14.

KEY WORDS

TFSO Data Designators
TFSO Data Group Numbers
Seismograph Response Characteristics
TFSO Seismometer Locations
TFSC Extended Array Site Locations
TFSO Seismograph Operating Parameters
and Tolerances

LINK A LINK B LINK C

ROLE	WT	ROLE	WT	ROLE	WT
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